

DESERT

PLANT LIFE

FOUR NATURAL HYBRIDS IN DUDLEYA

Reid Moran
Charles H. Uhl

CONTRABAND

E. Yale Dawson

READING and REFERENCE

REPORTS

Second Quarter -- April-July, 1952

Desert Plant Life Magazine

Official Publication AMERICAN SUCCULENT SOCIETIES

Chicago, Long Beach, Los Angeles

The oldest magazine in the English language devoted to the study of
cacti and other succulents.

APRIL, 1952

VOLUME 24

NUMBER 2

WHOLE NUMBER 189

DESERT PLANT LIFE. Published Quarterly by the Desert Magazine Publishing Company, 866 South Grand Avenue, Pasadena 2, California. Entered as second-class matter October 14, 1930, at the Post Office at Pasadena, California, under the act of March 3, 1879. Yearly subscription price \$1.50. In California 5 cents tax additional. Foreign countries, including Canada and Mexico, \$2.00. Single copies 25 cents.

Address all communications to Box 68, Pasadena, California

Editor: ELLEN ROOKSBY

EDITORIAL CONTRIBUTORS

ELISE BERGER

GEORGE LINDSAY

LEON CROIZAT, D.J.

REID MORAN, PH.D.

DR. E. YALE DAWSON

JOHN POINDEXTER, PH.D.

H. HERRE

JACK WHITEHEAD

SECOND QUARTER



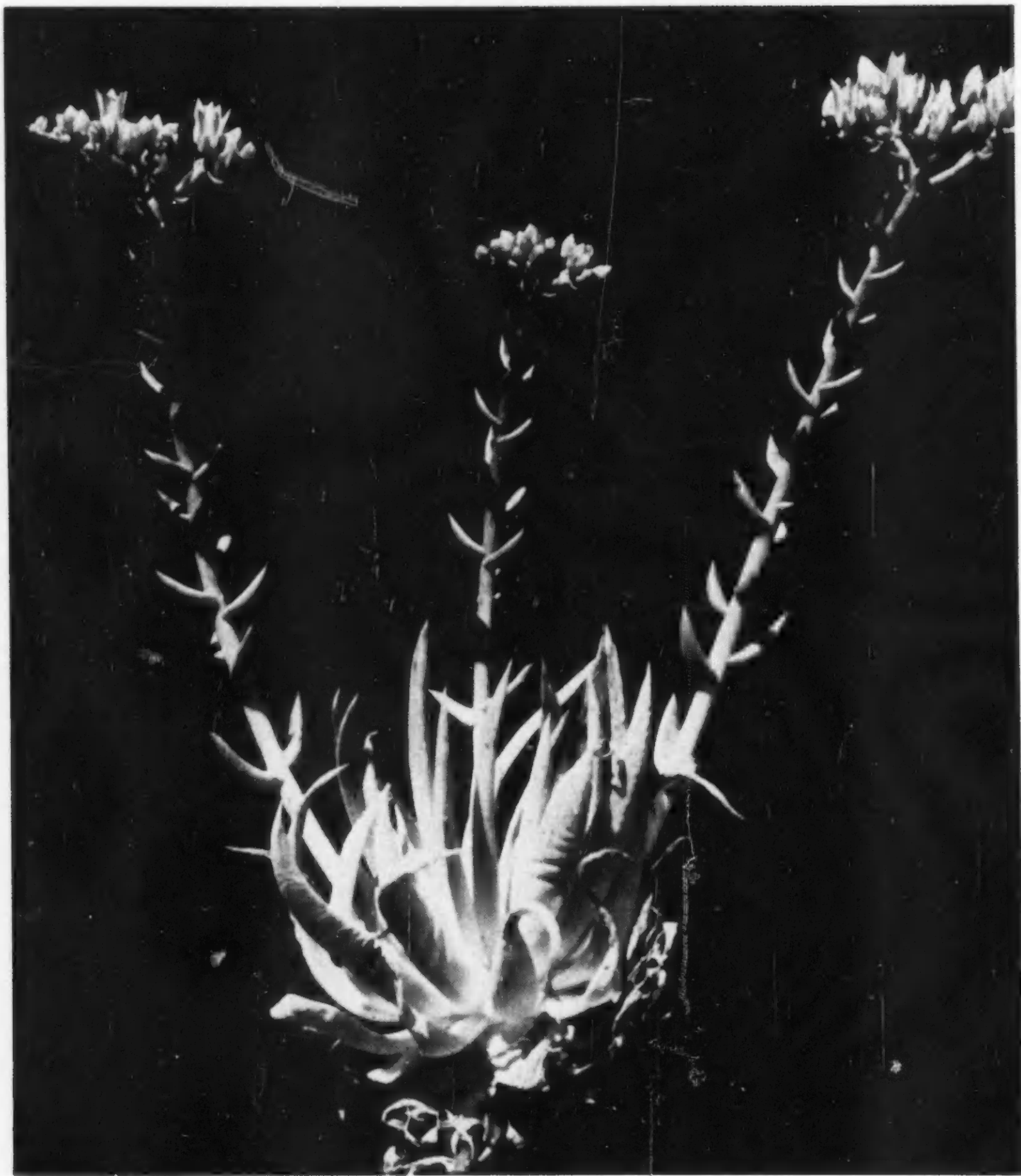


Fig. 1. *Dudleya* × *semiteres*. Ocean bluff one mile south of Rancho Cuevas, Baja California (2106). April 16, 1947.

Four Natural Hybrids in *Dudleya*

One natural hybrid in *Dudleya* and three between *Dudleya* and *Hasseanthus* have recently been described (Moran 1949, 1951). Despite some searching in places where more than one species of *Dudleya* occur, only four other apparent hybrids have been found.

As with those already described, none of these apparent hybrids has been duplicated artificially. The evidence for their hybridity is circumstantial: each of them is intermediate morphologically between the supposed parents, each of them has been found only with the supposed parents, and each of them is rare. Only one of them shows any irregularity at meiosis.

Type specimens are in the Herbarium of the University of California at Berkeley. Duplicates are to be distributed. In the citation of collections, each one studied cytologically is starred (*).

***Dudleya anthonyi* × *cultrata* Moran, hybrida nova.**

Inter parentes media sed *D. cultratae* similior. Rosulae folia 30-40, aliquanto glauca, 10-13 cm longa, circa 2 cm lata. Petala lutea rubrosuffusa, 12-14 mm longa, 3-4 mm lata, 4-6 mm connata.

Caudex 1½-4 cm thick, to 7 cm long, few branched. Rosettes about 1 dm wide, of 30-40 more or less erect leaves. Rosette leaves somewhat glaucous, oblong, tapering from the base, acute and subapiculate, 10-13 cm long, about 2 cm wide, 3-5 mm thick, flat or slightly concave ventrally, convex dorsally, the margins acute in the lower half, the base 2½-3 cm wide, 2-3 mm high. Floral stem 5½ dm tall, 6 mm thick, with about 20 leaves, leafless in the lower 1 dm. Cauline leaves triangular-lanceolate, acute, the lowermost 2½ cm long. Inflorescence of 3 simple or bifurcate branches, the cincinni 3-4 dm long, with 25-30 flowers. Pedicels erect, the lowermost 13 mm long. Calyx about 7 mm wide and 6 mm high, the segments triangular, acute, about 4 mm long and 3 mm wide. Petals yellow strongly charged with red, elliptic, acute, 12-14 mm long, 3-4 mm wide, connate 4-6 mm. Antesepalous filaments 8-10 mm long, adnate 3½-6 mm, epipetalous 7-9 mm long, adnate 3-5 mm; anthers about 1½ mm long. Scales white, 1½-2 mm wide. Pistils erect, the ovaries 8-8½ mm long, the styles 1½-2 mm long. Chromosome number: $n = 34$.

TYPE: With the parental species, San Martin Island, Baja California, Mexico, May 5, 1948, Moran 3058 (UC 917953).

DISTRIBUTION: Known only from the type collection.

This plant was found as an occasional individual with the two supposed parental species, both of which were abundant. As shown in Table 1, it is more or less intermediate between these species though in some respects more similar to *D. cultrata*.

Since *D. anthonyi* is diploid and *D. cultrata* is tetraploid, a hybrid between them might be expected to be triploid. In the type collection, few good meiotic figures were found and only one from which a definite count could be made. Judging from this figure, the gametic chromosome number is 34, and the plant thus appears to be tetraploid. A pollen fertility of 17 percent adds further evidence that it is not triploid.

These facts might seem to suggest that the plant is not a hybrid. How-

	DUDLEYA CULTRATA	Hybrid	DUDLEYA ANTHONYI
Caudex	2-4 cm thick, branching to bear about 10 rosettes	1½-4 cm thick, bearing 1-2 rosettes	5-9 cm thick, unbranched
Rosette leaves	20-30 Green, not glaucous 5-13 cm long, 10-15 mm wide	30-40 Somewhat glaucous 10-13 cm long, about 20 mm wide	35-90 Chalky-pulverulent 8-25 cm long, 30-70 mm wide
Floral stems	2-4 dm tall	5½ dm tall	4-10 dm tall
Pedicels	Erect, 5-12 mm long	Erect, the lowermost about 13 mm long	Spreading in anthesis, then erect, the lowermost 15-25 mm long
Petals	Pale yellow 10-13 mm long, connate 3-5 mm	Yellow strongly charged with red 12-13 mm long, connate 4-6 mm	Dark red 15-17 mm long, connate 5½-7 mm
Filaments	Epipetalous 7-8 mm long, adnate 2-3 mm Antesepalous 8-9 mm long, adnate 2½-4 mm	Epipetalous 7-9 mm long, adnate 3-5 mm Antesepalous 8-10 mm long, adnate 3½-6 mm	Epipetalous about 13 mm long, adnate about 6 mm Antesepalous about 14 mm long, adnate about 5 mm
Chromosomes	$n = 34$	$n = 34$; meiosis irregular	$n = 17$

Table 1

ever, of some 300 collections of *Dudleya* studied, this is the only one to show a certain abnormality also observed in hybrids of *Sempervivum* and of *Echeveria*. Instead of adjacent microsporocytes always being at nearly the same stage of meiosis, they appeared to be considerably out of step with each other. Furthermore, many "quartets" were abnormal, having more or fewer than four members. Finally, pollen fertility in this plant is about 17 percent, whereas in each of the parental species it is nearly 100 percent. Thus cytological evidence supports the view that the plant is a hybrid. If so, it appears that the *anthonyi* gamete must have been unreduced.

Dudleya* × *semiteres (Rose) Moran, status novus.

Stylophyllum semiteres Rose in Britton & Rose, Bull. N.Y. Bot. Gard. 3:35. 1903.

Cotyledon semiteres Fedde, Bot. Jahresber. Just. 31¹:829. 1904.

Echeveria semiteres Berger in E. & P., Nat. Pfl. ed. 2. 180:480. 1930.

Dudleya semiteres Moran, Leaf. West. Bot. 6:55. 1950.

Caudex short and erect, 1-3 cm thick, sometimes 15 cm high, eventually branching to form a cluster of 10-15 rosettes. Rosettes 3-10 cm wide, of 15-30 (-40) ascending leaves. Rosette leaves green or glaucous, tapering uniformly or the sides more or less parallel in the lower half, sharply acute or somewhat apiculate, 3-10 (2-18) cm long, 6-15 mm wide, 3-6 mm thick, the ventral surface flat or slightly convex, the dorsal surface convex, the margins acute in the lower fourth but rounded above, the apex terete, the base 6-25 mm wide. Floral stems 1-3 (-5) dm tall, 3-8 mm thick, with about 12-30 ascending leaves. Cauline leaves triangular-lanceolate, acute, turgid but flattened, the lowermost 1-3 (-6) cm long, 3-7 (-15) mm wide. Inflorescence usually of 2-4 ascending simple or bifurcate branches. Cincinni 3-10 cm long, with 3-12 (-20) flowers. Pedicels erect, the lowermost 3-8 mm long. Calyx 4-5 (-6) mm wide, 4-6 (-8) mm high, the segments triangular-ovate to -lanceolate, acute, 3-5 (-6) mm long, 1½-2 (-3) mm wide. Petals white or yellowish white, often red-lineolate on the keel, elliptic-oblong, acute, 8-10 mm long, 2-3½ mm wide, erect in the lower half and connate 1½-2½ mm, ascending-spreading above. Stamens erect, the epipetalous filaments 5-6 mm long, adnate 1½-3 mm, the antesealous filaments 5½-6½ mm long, adnate 1-2 mm; anthers red or yellow, 1-1½ mm long. Scales ½-1 mm wide. Pistils erect, at first appressed but becoming separated, the ovaries 4½-6½ mm high, the styles 1½-2 mm long. Chromosome number: $n = 17$. Flowers April to June.

TYPE: Lower California or the Colorado Desert of California, C. R. Orcutt; Rose 608 (US 431331).

DISTRIBUTION: Banks and hillsides near the sea, northern Baja California: Rancho Cuevas to Ensenada Point; South Coronado Island and South Todos Santos Island.

OTHER COLLECTIONS: BAJA CALIFORNIA: South Coronado Island, Moran 2205*; Rancho Cuevas, Moran 2106*, 3264*; Rio Guadalupe (north of), Moran 2124, 2209, 3100; Rio Guadalupe, Moran 3265*; Punta Ensenada, Moran; South Todos Santos Island, Moran 3064*.

Dudleya semiteres is known from only a few scattered localities. Whereas most species of *Dudleya* are abundant wherever they occur, *D. semiteres* is always uncommon or rare: sometimes only one or two individuals were found and never more than about a dozen. Wherever *D. semiteres* has been found, *D. attenuata orcuttii* also occurs; and *D. brittonii* occurs at all

these localities except South Coronado Island, where it is replaced by the closely allied *D. candida*. Comparison (Table 2) shows that *D. semiteres*, as it occurs with *D. brittonii*, is more or less intermediate between that species and *D. attenuata orcuttii*. As it occurs with *D. candida* on South Coronado Island, *D. semiteres* is somewhat smaller than at these other localities, just as *D. candida* is somewhat smaller than *D. brittonii*. Specifically, in plants of South Coronado Island the rosette leaves were 2 to 6 cm long, with bases 6 to 13 mm wide, whereas in plants occurring with *D. brittonii* the rosette leaves were 5 to 18 cm long, with bases 10 to 27 mm wide.

Since *D. brittonii* is a large plant and *D. attenuata orcuttii* small, it might be expected that the medium-sized *D. semiteres* would fall between them in the size of various parts. However, *D. semiteres* is more or less intermediate in nearly all respects, not merely in size of parts. Since *D. semiteres* is uncommon, is found only with *D. attenuata orcuttii* and *D. brittonii* or *D. candida*, and is morphologically intermediate between them, and since its variation in size more or less parallels the difference in size of *D. brittonii* and *D. candida*, it appears likely that *D. semiteres* is a recurrent hybrid between *D. attenuata orcuttii* as one parent and *D. brittonii* or *D. candida* as the other.

In five collections of *D. semiteres* from different localities throughout the range, the gametic chromosome number is 17, just as in each of the putative parental species. No sign of irregularity in meiosis was seen.

There is little evidence concerning the fertility of *D. semiteres*. In four collections examined, from 6 to 72 percent (average 28 percent) of the pollen grains appeared abnormal. In three collections with mature or nearly mature follicles, not more than three apparently normal seeds were found per follicle and sometimes none. In two collections the pistils were withered before maturity, though it is not known whether this was in any way connected with failure of seeds to mature for genetic reasons. It can at least be said that there is some appearance of lowered fertility in *D. semiteres*.

Thus it appears likely, though not indisputable, that *D. semiteres* is a recurrent natural hybrid. The putative parents are so very different from each other that the intermediate *D. semiteres* would not at first glance be associated with either of them but would be taken for an entirely distinct species. Furthermore, *D. semiteres* is not localized like the other natural hybrids thus far detected in the genus but occurs sporadically through a range of some 50 miles. It therefore seems best to continue to treat this plant under the original epithet; but the name should now be written *D. × semiteres*.

If *D. × semiteres* is of hybrid origin, then actually two hybrids are here included under the one name. One parent in each hybrid is *D. attenuata orcuttii*. The second parent of one hybrid is *D. brittonii* and that of the other hybrid is *D. candida*. *Dudleya brittonii* and *D. candida* are closely related and probably should be regarded as subspecies of one species. As mentioned above, the principal difference noted between the two hybrids is in size. Since the type specimen is more or less intermediate in size and since its place of origin is unknown, the type specimen cannot be definitely identified with one hybrid or the other. Since the two hybrids are similar, however, they are both included in *D. × semiteres*. If nomenclatural distinction seems necessary, the formula names may be used.

	DUDLEYA BRITTONII	DUDLEYA SEMITERES*	DUDLEYA ATTENUATA ORCUTTHI*
Caudex	Unbranched, 2-10 cm thick	Few branched, 1-3 cm thick	Many branched, 3-15 mm thick
Rosette leaves	40-120 Oblong Broad and flat 7-25 cm long, 3 1/2-8 1/2 cm wide, 4-11 mm thick	15-40 Linear-deltoid to oblong Semiterete or broader 5-10 (-18) cm long, 6-15 mm wide, 3-6 mm thick	5-20 Linear-oblongeolate Mostly terete 3-10 (-15) cm long, 2-7 mm wide, 2-6 mm thick
Floral stem	2-10 dm tall 6-20 mm thick	1-5 dm tall 3-8 mm thick	1/2-2 1/2 dm tall 1-5 mm thick
Cauline leaves	20-35, horizontal Flat and thin Lowermost 1 1/2-5 1/2 cm long, 5-25 mm wide	12-30, ascending Turgid but flattened Lowermost 1-6 cm long, 3-15 mm wide	6-15, ascending Mostly terete Lowermost 1/2-3 1/2 cm long, 2-5 mm wide
Cincinni	Several to many	Mostly 2-8	Mostly 1-3
Pedicels	Lowermost 10-22 mm long	Lowermost 3-8 mm long	Lowermost 1/2-5 mm long
Sepals	3-6 mm long, 2-4 mm wide	3-6 mm long, 1 1/2-3 mm wide	1 1/2-4 mm long, 1-2 mm wide
Petals	Pale yellow Erect	White or yellowish white, often marked with red Erect in lower half, ascending above	White suffused with rose, with red on keel Erect below, widespreading to ascending-spreading above
Filaments	9-13 mm long, connate 1 1/2-4 mm	8-10 mm long, connate 1 1/2-2 1/2 mm	6-10 mm long, connate 1/2-3 mm
Pistils	6-9 1/2 mm long Erect, appressed Ovaries 5 1/2-7 mm high Ovules about 60 Styles 1 1/2-2 mm long	5-6 1/2 mm long Erect, first appressed, then separated Ovaries 4 1/2-6 1/2 mm high Ovules about 25-35 Styles 1 1/2-2 mm long	3 1/2-6 mm long Erect but separated Ovaries 3-4 1/2 mm high Ovules about 14-18 Styles 1-2 1/2 mm long
Follicles	Erect, appressed	Nearly erect, but separated	Ascending
Chromosomes	$n = 17$	$n = 17$; meiosis normal	$n = 17$

*As it appears in the area of *D. brittonii*

Table 2



Fig. 2. Type specimen of *Stylophyllum semiteres* Rose.

***Dudleya brittonii* × *formosa* Moran, hybrida nova.**

Planta inter parentes valde media. Rosulae folia ambitu et magnitudine intermedia, viridia ut apud *D. formosam*, non glauca. Petala parte inferiore erecta, apice ad circa 45° excurvata. Folliculi adscendentes vel suberecti.

Caudex 2-4½ cm thick, unbranched or branched several times and bearing up to about 20 rosettes. Rosettes 1-2½ dm wide, of 25-40 leaves. Rosette leaves green, not at all glaucous, oblong, short-acuminate, 5-12 cm long, 2½-5 cm wide, 3-4 mm thick, convex dorsally and ventrally, the margins subacute. Floral stems red, 2-4 dm tall, 4-8 mm thick at the base, with about 10-17 leaves. Cauline leaves cordate-ovate, acute, horizontal, the lowermost 1½-3 cm long, 1-2 cm wide. Inflorescence rather dense, 5-11 cm in diameter, obpyramidal, flat or rounded above, of about 5 branches that rebranch once or twice. Cincinni ascending, 2-6 cm long, with 3-12 flowers. Pedicels erect, thickening slightly upward, the lowermost 4-8 mm long, about 2 mm thick. Calyx 4-5 mm wide, 4-5 mm high, rounded below, the segments triangular, acute, 2½-4½ mm long, 2-4 mm wide. Petals white or tinged with pink, elliptic, acute, 10-12 mm long, 3-3½ mm wide, erect in the lower half and connate 1½-2½ mm, the tips curved outward at about 45°. Filaments 7½-9 mm long, the antesealous adnate 2-3 mm, the epipetalous adnate 3-3½ mm; anthers red, about 1½ mm long. Scales whitish, about 1 mm wide. Pistils suberect but separated, the ovaries about 5½-6 mm long, with about 40 ovules, the styles about 2 mm long. Predehiscent follicles slightly separated or ascending with the ventral margins about 75° above the horizontal. Chromosome number: $n = 17$.

TYPE: North-facing cliffs near the mouth of the Rio Guadalupe (= Rio San Miguel), northern Baja California, Mexico (near 32°05.6' N, 116°52.8' W), June 24, 1948, *Moran 3104* (UC 806721).

DISTRIBUTION: Known only from the type locality and its immediate vicinity.

OTHER COLLECTIONS: BAJA CALIFORNIA: Rio Guadalupe, *Moran 3267**, *3416**.

At the type locality, *Dudleya formosa* is abundant on the nearly vertical cliffs, with an occasional straggler on the talus slopes below. *Dudleya brittonii* is abundant on these same cliffs and slopes, here occurring only in the white form, though the green form grows close by. Growing with *D. brittonii* and *D. formosa* are a few plants intermediate in appearance. Because they have been found only with *D. brittonii* and *D. formosa* and are comparatively rare, and because they are in so many respects intermediate, these plants are assumed to be hybrids.

Dudleya attenuata orcuttii, *D. edulis*, and *D. × semiteres* also occur in the vicinity of the type locality. Each of these was considered as a possible parent, but the hybrid is more clearly intermediate between *D. brittonii* and *D. formosa* than between any other pair of species. In particular, certain characters of the hybrid seem to eliminate all but these two species from consideration as possible parents. *Dudleya brittonii* is much the largest of the five species. The hybrid exceeds the other four species in thickness of caudex and width of cauline and rosette leaves. It therefore appears that *D. brittonii* must have been one parent. In a cross with *D. brittonii*, it appears that of the other four species only *D. formosa* could produce the

	DUDLEYA BRITTONII	Hybrid	DUDLEYA FORMOSA
Caudex	Unbranched 4-10 cm thick	Unbranched or several times branched 2-4½ cm thick	Much branched ½-2½ cm thick
Rosette leaves	40-120 Glaucous 7-25 cm long, 3½-8 cm wide Short acuminate	25-40 Green 5-12 cm long, 2½-5 cm wide Short acuminate	10-30 Green 2-8 cm long, 1-3 cm wide Acute to obtuse
Floral stems	2-10 dm tall, 7-20 mm thick	2-4 dm tall, 4-8 mm thick	4-19 cm tall, 3-6 mm thick
Cauline leaves	20-35 Lowermost 1½-5½ cm long, 7-25 mm wide	20-35 Lowermost 1½-3 cm long, 10-20 mm wide	10-17 Lowermost 8-21 mm long, 4-12 mm wide
Inflores- cence	Rather open, obpyramidal to cylindric 7-22 cm in diameter	Rather compact, obpyramidal, flat or rounded above 5-11 cm in diameter	Compact, mostly hemispherical 2-7 cm in diameter
Cincinni	2-11 cm long, with 6-15 flowers	2-6 cm long, with 3-12 flowers	1-2 cm long, with 2-6 flowers
Pedicels	Lowermost 10-22 mm long, 1-1½ mm thick below, thickening to 2-3 mm above	Lowermost 4-8 mm long, about 2 mm thick, thickening slightly upward	Lowermost 1-3 mm long, 2-2½ mm thick, cylindrical
Sepals	3-6 mm long, 3-4 mm wide	2½-4½ mm long, 2-4 mm wide	1½-2 mm long, 2½-3½ mm wide
Petals	Pale yellow 12-13 mm long, 2½-3½ mm wide Erect Connate 2-3 mm	White or tinged with pink 10-12 mm long, 3-3½ mm wide Erect below, the tips outcurved Connate 1½-2½ mm	White tinged with pink or with bright red 8-9 mm long, 3-4 mm wide Rotately spreading from below Connate 1-1½ mm
Predehiscent follicles	Erect, appressed	Erect and slightly separated, or ascending with ventral margins about 75° above the horizontal	Ascending-spreading, ventral margins about 45° above the horizontal
Ovules	About 60	About 40	About 30
Chromosomes	$n = 17$	$n = 17$; meiosis regular	$n = 17$

Table 3

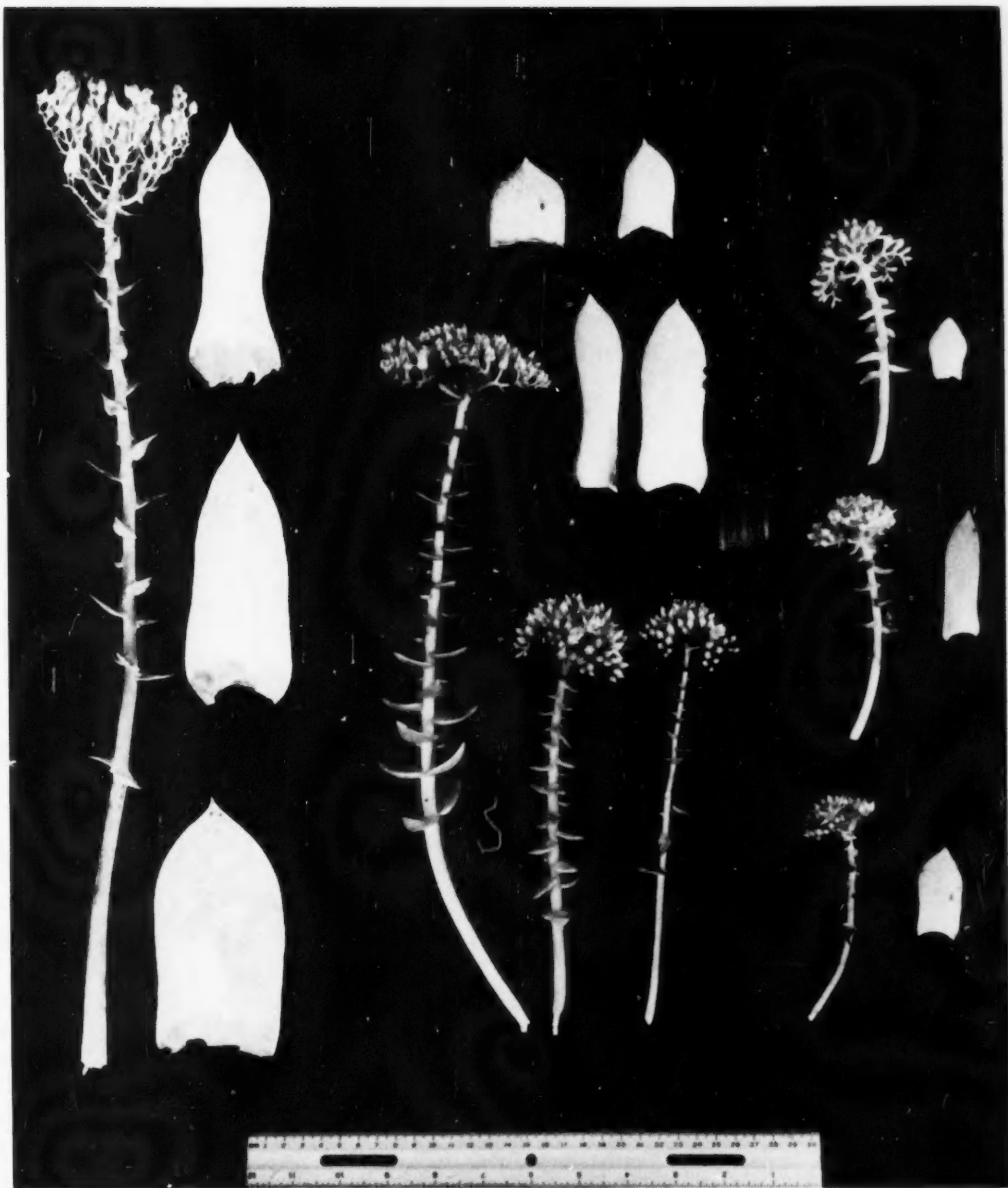


Fig. 3. Rosette leaves and floral stems of *Dudleya brittonii* (left), *D. formosa* (right), and hybrid (center). Cliffs near the mouth of Rio Guadalupe, Baja California, type locality of the hybrid. May 27, 1950.

broad leaves, relatively compact inflorescence, thick pedicels, and pink petals of the hybrid.

In the two collections of the hybrid examined, the gametic chromosome number is 17 as in the parental species. Meiosis, quartets, and young pollen all look normal. In mature pollen of two collections, the percentage of bad grains was 1.2 and 5.5.

At the type locality on July 5, 1950, seeds of the hybrid were not quite mature, but it appeared that only about one or two, or rarely as many as ten, ovules were developing in each pistil. In the parental species likewise not all ovules were developing: *D. brittonii* had about 20 good ovules per pistil and *D. formosa* about five to eight. From these observations, it appears that the fertility of the hybrid probably is at least somewhat lower than that of the parental species.

***Dudleya attenuata orcuttii* × *formosa* Moran, hybrida nova.**

Inter parentes plus minusve media. Rosulae folia linearia usque triangulolinearia, 6-8 mm lata. Inflorescentia obpyramidalis, 3-4 ramosa, ramis simplicibus usque bis furcatis. Filamenta $5\frac{1}{2}$ -8 mm longa. Folliculi adscendentes, marginibus ventralibus circa 30-60° acclivibus.

Caudex 7-20 mm thick, becoming 15 cm long, branching to bear a loose cluster of 10-12 rosettes. Rosettes 4-5 cm wide, of 12-20 ascending leaves. Rosette leaves glaucous, linear to linear-deltoid, sharply acute, 6-9 cm long, 6-8 mm wide above, 3-4 mm thick, the margins acute in the lower third, rounded above, the base 12-15 mm wide. Floral stems pink, 8-15 cm tall, 2-4 mm thick, with 6-18 ascending leaves, bare in the lower 4-5 cm. Cauline leaves triangular-lanceolate to -ovate, acute, turgid, the lowermost 1-1½ cm long, 4-5 mm wide. Inflorescence obpyramidal, of 3-4 branches that rebranch 0-2 times. Cincinni ascending, 3-5 cm long, with 5-8 flowers. Pedicels erect, rather stout, the lower 1-2 mm long. Calyx about 4 mm wide, 3-4 mm high, the segments triangular, acute, 2-3 mm long, about 2 mm wide. Petals rose or pink, red-lineolate on the keel, elliptic, acute, 8-10 mm long, 2½-4 mm wide, erect below and connate 1½-2 mm, ascending or spreading above. Filaments ascending, the epipetalous 5½-7 mm long, adnate 2½-3 mm, the antisepalous 6-8 mm long, adnate 1½-2 mm; anthers red, about 1 mm long. Pistils ascending, the ovaries 4½-6 mm high, the styles 1½-2 mm long. Follicles ascending to spreading, the ventral margins about 30-60° above the horizontal. Chromosome number: $n = 17$. Flowers May to June.

TYPE: North-facing cliffs at the mouth of the Rio Guadalupe, (= Rio San Miguel), northern Baja California, Mexico, June 24, 1948, *Moran 3103* (UC 917952).

DISTRIBUTION: Known only from the type locality.

OTHER COLLECTION: BAJA CALIFORNIA: Rio Guadalupe, *Moran 3268**.

This plant was found on a small ledge with *D. attenuata orcuttii*, *D. brittonii*, *D. formosa*, and *D. brittonii* × *formosa*. *Dudleya* × *semiteres* also grows within a few hundred feet and *D. edulis* within a mile or so. All these plants are diploid, with a gametic chromosome number of 17.

The plant under consideration has been found only at this one spot where several diploids occur together. This fact suggests that it might be a hybrid. If it is a hybrid, then—since the several individuals were fairly uniform—it probably is a first-generation hybrid and hence bispecific. On this assump-

	DUDLEYA ATTENUATA ORCUTTII*	Hybrid	DUDLEYA FORMOSA
Caudex	Much branched 1/2-1 1/2 cm thick	Several times branched 1-2 cm thick	Much branched 1/2-2 1/2 cm thick
Rosette leaves	Linear-oblancoate 3-10 (-15) cm long, 2-5 mm wide, 2-5 mm thick Terete	Linear to linear-deltoid 6-9 cm long, 6-8 mm wide, 3-4 mm thick Flattened ventrally; margins acute below, rounded above	Oblong to oblong-obovate 2-8 cm long, 10-30 mm wide, 3-6 mm thick Broad and flat; margins subacute
Floral stems	5-25 cm tall, 1-5 mm thick	8-15 cm tall, 2-4 mm thick	4-19 cm tall, 3-6 mm thick
Cauline leaves	Triangular-lanceolate Ascending 8-25 mm long, 2-5 mm wide	Triangular-lanceolate to -ovate Ascending 10-15 mm long, 4-5 mm wide	Triangular-lanceolate to -ovate Horizontal 5-35 mm long, 2-5 mm wide
Inflorescence	Mostly of 1-3 cincinni	Of 3-4 branches that rebranch 0-2 times	Of 3-7 branches that usually rebranch 1-2 times
Cincinni	3-11 cm long, with 3-12 flowers	3-5 cm long, with 5-8 flowers	1-2 cm long, with 3-6 flowers
Pedicels	Lowermost 1-4 mm long	Lowermost 1-2 mm long	Lowermost 1-3 mm long
Sepals	2-4 mm long, 1 1/2-2 mm wide	2-3 mm long, about 2 mm wide	1 1/2-2 mm long, 2 1/2-3 1/2 mm wide
Petals	White suffused with rose, red-lineolate on keel 6-10 mm long, 2 1/2-3 mm wide	Pink, red-lineolate on keel 8-10 mm long, 2 1/2-4 mm wide	White tinged with pink or with dark red 8-9 mm long, 3-4 mm wide
Filaments	3 1/2-6 mm long	5 1/2-8 mm long	5-6 1/2 mm long
Follicles	Ascending, the ventral margin about 45-60° above horizontal	Ascending, the ventral margin about 30-60° above horizontal	Spreading, the ventral margin about 5-20° above horizontal
Chromosomes	$n = 17$	$n = 17$; meiosis regular	$n = 17$

*As it appears in the area of *D. formosa*

Table 4

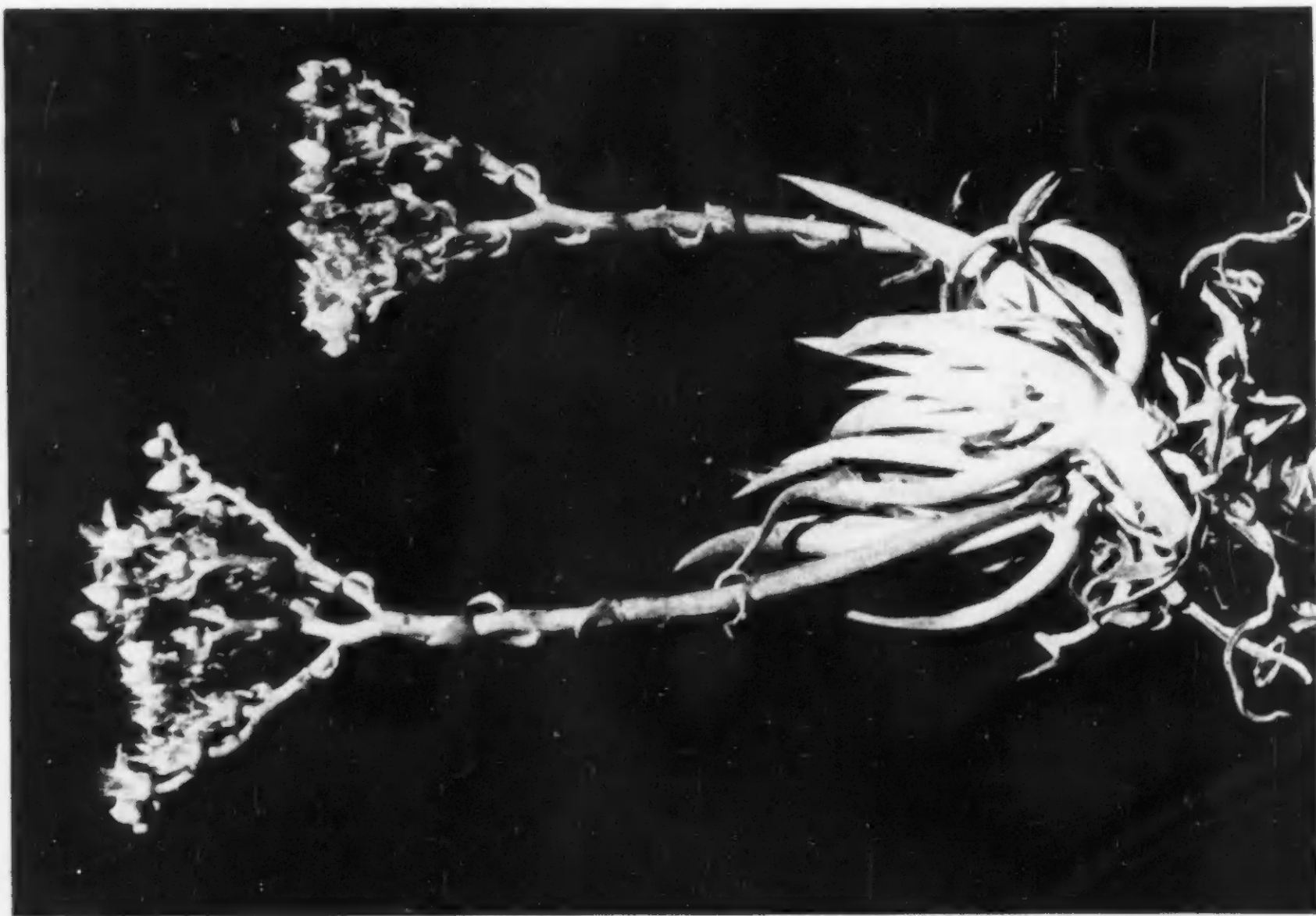
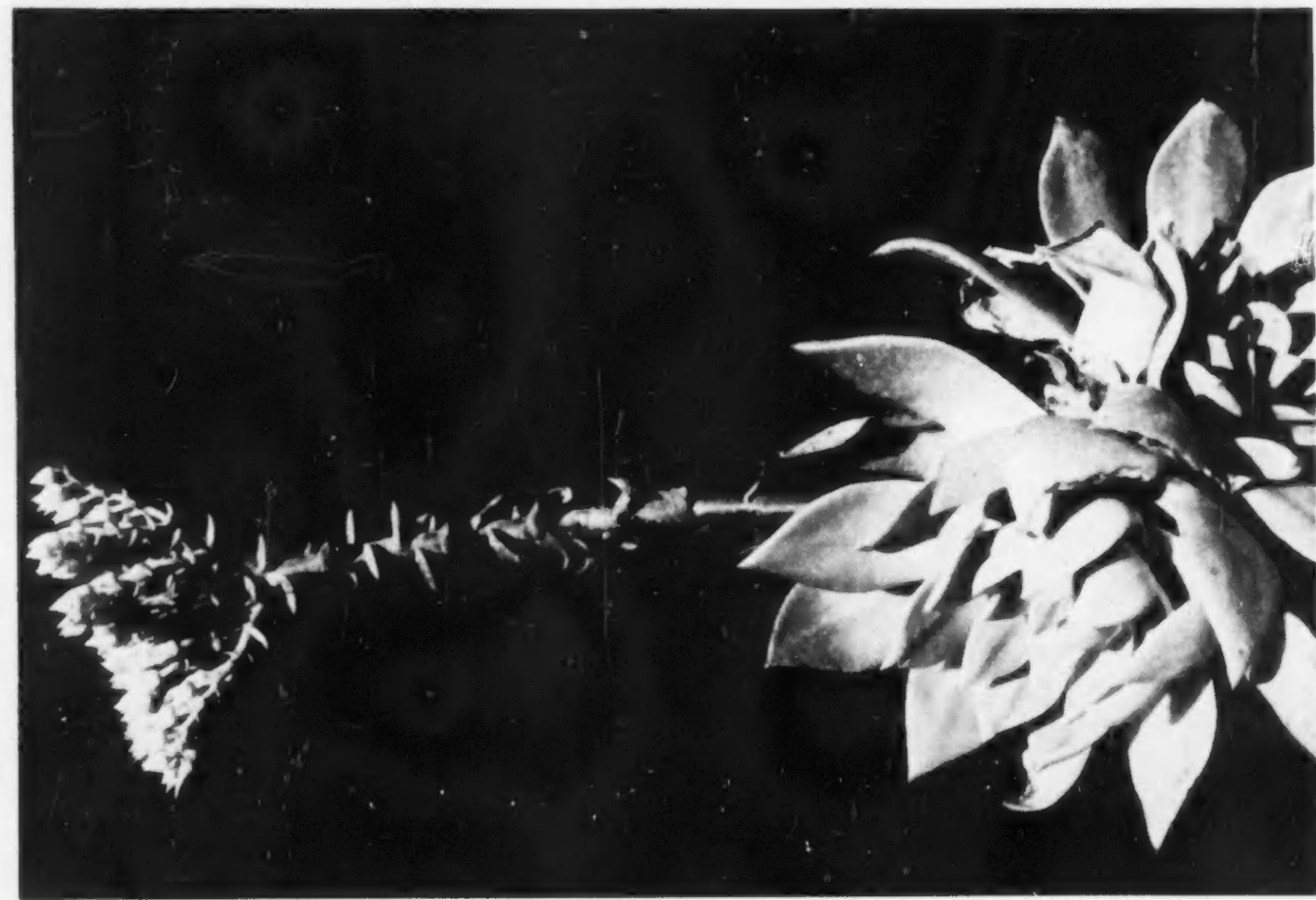


Fig. 4. *Dudleya brittonii* \times *formosa*. Type specimen (3104). June 24, hybrid (center). Same place and time as fig. 4. Millimeter scale at bottom.

Fig. 5. *Dudleya attenuata orcuttii* \times *formosa*. Type specimen (3103). June 24, 1948.

tion, the most likely parents have been selected by comparison with the species occurring in the vicinity.

The short stout pedicels, the short broad sepals, and the broad pink petals all point to *D. formosa* as one parent. It seems unlikely that any one of these three characters would appear in any possible hybrid of the other three or four species in this vicinity. Therefore it is assumed that *D. formosa* is one parent.

With *D. formosa* as one parent, the most likely second parent is *D. attenuata orcuttii*. Comparison (Table 4) shows that in nearly every respect the supposed hybrid is more or less intermediate between these two species as they occur at this locality. The only conspicuous exception is in the length of the filaments.

With regard to morphology, *D. × semiteres* would perhaps be the next most likely choice as the second parent. If it were the parent, however, the hybrid might be expected to have wider leaves than it does and more erect petals and carpels. Again the stamen length of the supposed hybrid is an obstacle. Furthermore, if the fertility of *D. × semiteres* is reduced, so also is the likelihood of its being the parent. And if *D. semiteres* is correctly diagnosed as being itself a hybrid, then uniformity would scarcely be expected in the progeny of *D. × semiteres* and *D. formosa*. Thus *D. × semiteres* does not seem a likely parent.

Dudleya brittonii is a much larger plant than *D. formosa*. A hybrid between them might be expected to differ from *D. formosa* in having a thicker caudex, more numerous and larger rosette leaves, taller floral stems, and more erect petals. These, in fact, are the characters of the plant identified as *D. brittonii × formosa*, which is very different from the plant under consideration. Therefore, *D. brittonii* seems most unlikely as the second parent.

Dudleya edulis was not seen in the immediate vicinity, but it does occur within a mile or so and perhaps closer. This is a somewhat larger plant than *D. formosa* and in crossing with it might be expected to produce a hybrid at least slightly larger in various parts. Furthermore, the hybrid might be expected to have a more open inflorescence than it does, green rather than glaucous leaves, and widespreading follicles. There is nothing about the supposed hybrid to suggest *D. edulis* as a parent.

Thus if the unknown plant is a hybrid, the most likely parents are *D. attenuata orcuttii* and *D. formosa*. Since it is known only from one spot, where these species occur, and since it is morphologically intermediate between them, the best tentative conclusion seems to be that this plant is the hybrid *D. attenuata orcuttii × formosa*.

In the one collection of this hybrid examined, the gametic chromosome number is 17, just as in each of the parental species. No sign of irregularity in meiosis was seen.

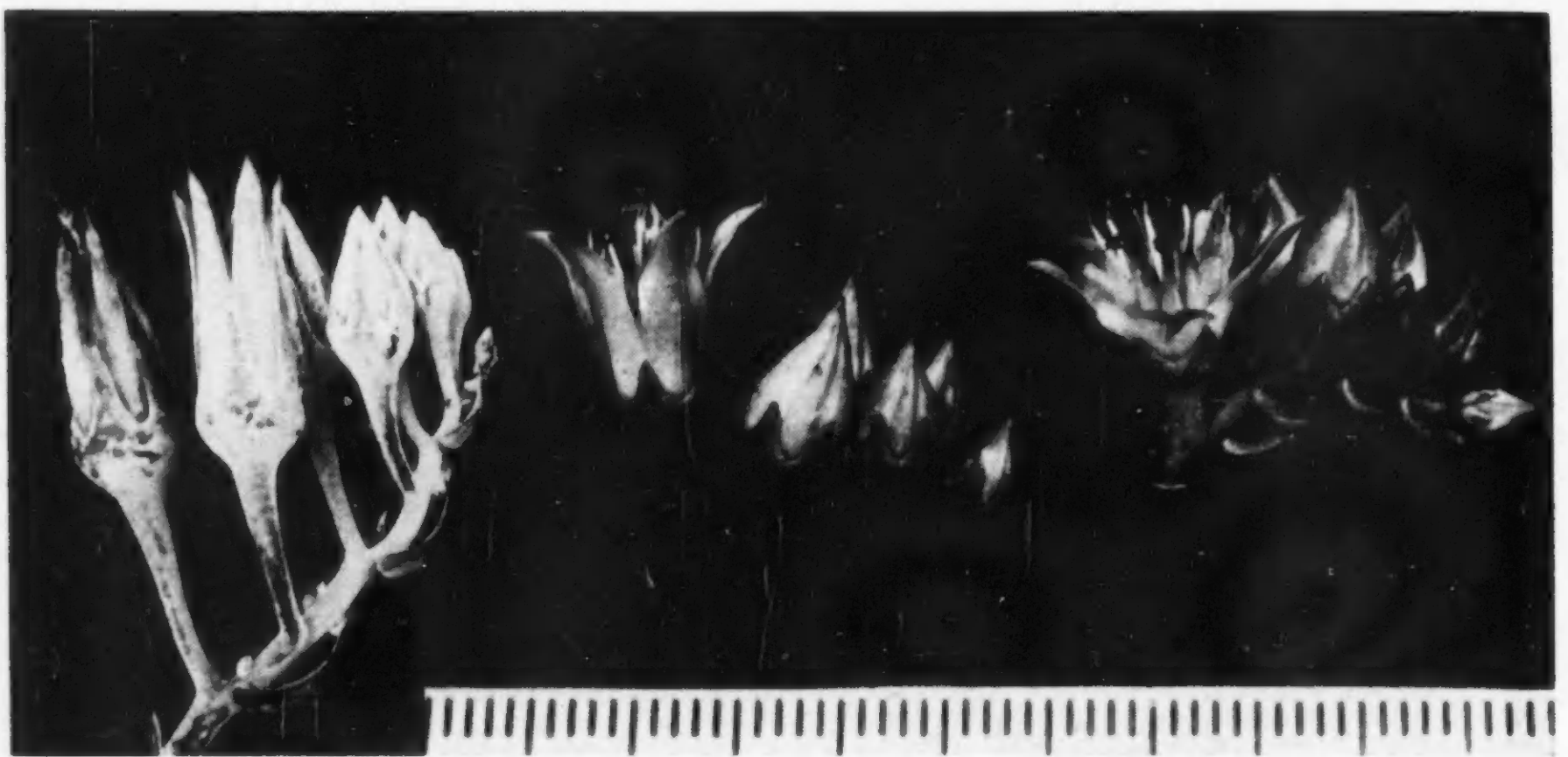


Fig. 6. Flowers of *Dudleya brittonii* (left), *D. formosa* (right), and hybrid (center). Same place and time as fig. 3. Millimeter scale at bottom.

Postscript: *Dudleya anthonyi* \times *cultrata*

As some of the taller weeds and denser brush were being cleared from the Moran cactus patch at La Cañada, California, a flowering specimen from the type collection of this hybrid came to light. It is larger than the wild plants originally described, doubtless partly because of the unusually heavy rains of the past winter, which amounted to some 41 inches. The leaves are quite glaucous, 2 dm long, 4 cm wide; the floral stems 10-12 mm thick at the base, with 30 to 40 leaves; and the corolla only faintly suffused with red. However, there seems to be no reason to doubt the identity.

Abundant cytological material from this plant showed even more meiotic irregularity than did the material previously studied. Once again, adjacent sporocytes were dividing asynchronously, and "quartets" had more or fewer than four members. Furthermore, univalents and perhaps trivalents were seen as well as bivalents. From figures in the young anther walls, it appears that this plant is triploid, with $2n = 51$ chromosomes. However, this count casts no doubt on the statement that the plant previously studied appeared to be tetraploid.

This collection is the first triploid found in *Dudleya*. Since a triploid was to be expected in this cross, little doubt now remains that this plant is indeed a hybrid.

REFERENCES CITED

- Moran, R. V. 1949. *Dudleya stolonifera*, a new species from Orange County, California. Bull. So. Calif. Acad. **48**: 105-114.
 ——— 1951. Natural hybrids between *Dudleya* and *Hasseanthus*. Op. cit. **50**: 57-67.

CONTRABAND

Some twenty-five years ago southern California was invaded by an epidemic of a then little-known disease called *cactusitis*. The afflicted individuals were characterized by an intense craving to handle all manner of spine-covered plants, and by an insatiable urge to venture into waterless desert wastes in search of such succulent vegetables as might be found inhabiting a dry gully or a boulder strewn mesa.

I was exposed, and contracted a virulent form of this malady when I was quite young, and by the time high school years were being met and conquered, my case had become chronic-incurable. At first mother and father had looked upon the consequences of my cravings as something that would soon pass away—something to be endured along with other hardships connected with the rearing of offspring. But, as sections of the lawn and garden were replaced by transplanted bits of the desert, as rocks began to replace shrubbery in the yard, and finally, as requests were tendered for the chopping down of the fruit trees, they began to view the situation with growing alarm. Fortunately for me, it was not long before the public's interest and general approval engendered by my uncommon behavior imparted some compensation for the sacrifice of the more usual attributes of a middle-class family's back yard. Gradually their submission was achieved, for one concession gained made the next easier.

Shortly after this critical period of indoctrinating my family, a major earthquake shook our community. A part of our house, like many others, was demolished, and the frantic populace took to camping in the streets awaiting the expected tidal waves or the occurrence of even more destructive shocks. All of this affected me rather little, but I was greatly disturbed over the loss of my prized *Ariocarpus fissuratus* and the upsetting of several trays of precious seedlings in my little glasshouse. The irritation and sadness over losses was shortlived, however, for suddenly I had a great idea. I had noticed soon after the quake that dump trucks were rumbling back and forth, hauling the debris of fallen brick walls from the streets. I succeeded in halting one of these trucks, and, as I calmly explained to my mother how I soon would be needing such material for constructing the desert garden, the truck driver obligingly dumped several tons of the rubble in our front yard.

Four of these huge piles of debris were soon added to our real estate and appropriately distributed. Within the next several weeks I scooped and hauled twenty trailer loads of decomposed granite from the Hollywood hills and added these as topping. My plan for a miniature desert landscape became a reality. Then it was only a matter of convincing my now patient and submissive parents that we should take some nice vacation trips to obtain proper specimens to exhibit on the finished planting site.

Among my fellow cactus enthusiasts was George, a business man whose lumber yard had suffered progressive retreat from the expansion of his

cactus garden. A buyer would come into the yard, pass under towering Joshua Trees, walk down winding paths bordered by cactus beds, and then, far over on the side of the lot reserved for lumber, he would be cautioned: "Careful with these boards, now. Don't knock over my potted plants."

George was very much absorbed in his hobby and missed no opportunity to dash away from his business for a day or two in the desert whenever a holiday turned up. One Thursday morning preceeding a three-day weekend holiday he called our house and suggested that we accompany him on a cactus hunt in southern Arizona. He said, "Just hook on the trailer, put in a shovel, some boxes and burlap, and come along. I'll meet you in El Centro at ten tonight."

The next day we left El Centro very early, crossed the Colorado River and drove on through the saguaro forests to Gila Bend, then south to Ajo and east into the Papago Indian country. At Sells Trading Post we obtained a government permit to collect cacti from the Indian lands, and with this preliminary accomplished we turned toward the Mexican border to grapple with a genuinely bad desert road. By this time the sunlight shown only on the high, bare rock of Baboquivari Peak and the rolling, brush-covered hills were already in deep shadow.

The little Presbyterian mission at San Miguel was maintained by two able spinsters, Miss Birdie Gilgert and Miss Elizabeth Wolfe. It was a wild country for two maiden ladies, and their experiences had occasionally, been highly exciting, if not dangerous. The Mexican border, unpatrolled, and delimited only by a barbed-wire fence that ran across the sweeping desert valley, then the hills and mountains, was only two miles from their adobe house. San Miguel was one of the few places where a passable road reached the border from the United States and met nothing but desolation from across the line. The road, in fact, led finally to an Indian dwelling whose back fence was the international boundary.

On just such a night as that on which we journeyed to San Miguel, a wanderer near the boundary fence might have seen several men on horseback emerge from the distant darkness and make their way along the desert washes, between mesquite and palo verde, toward the fence. Could he have seen their faces he would have noticed that they were not all of the same complexion. Most of them had flat, roundish faces and slanted, oriental eyes. Some distance from the fence the Chinese dismounted and walked to a place where they could slip under the wires. Then, as their guides led the horses back into the Sonoran desert they proceeded toward a rendezvous in an arroyo at the edge of the two wheel tracks that led north. They were in the fabulous United States now and presently would be met by fellow conspirators who would, for an exalted price, take them out of the desert and to some great city where they would be safe from suspicious eyes until friends were found.

Many thousands of Chinese had come to Mexico and had waited for the opportunity to come into the United States with a quota. But the quota was so small, and the waiting line so long, that the more impatient ones were willing to venture association with those who dealt in the smuggling of human beings rather than goods across the border. Not all could afford the

high prices asked, but those who could were reminded that the privileges of living in the United States far outweighed the cost of the move. And so they came. In the early years it was easy to land a surf boat from a ship lying off the unpopulated coast of Southern California. Before 1914 over two thousand orientals had been brought ashore to a single rendezvous spot below the high cliffs north of La Jolla. As the spreading population brought more and more hazard to the Southern California coast the business of unlawful entry shifted eastward into the desolate southwest desert areas.

Miss Gilgert and Miss Wolfe had, over the course of their many years of service at the mission, responded on several occasions to the knock of strangers at the door in the middle of the night. Sometimes they were Indians from Sells inquiring of directions; but from time to time there were Americans or Mexicans with no apparent business down there whose queries or demands were backed up by such boldness that it was plain they were not to be trifled with. Unprotected as they were, the two ladies could only comply with whatever requirements they faced at the hands of these people, and let them go on their way unmolested with their unlawful cargo.

When we drove into the big yard by the schoolhouse, it was nearly midnight, but there was one small light still burning in the missionaries' house. One of them was reading in bed. George had obtained from a friend a sort of verbal introduction to these ladies and felt that he might persuade them to give us a place to stay, for the midnight air of March was now cold. George went to the house and knocked loudly at the door. The light was hastily extinguished and there came no response. After several attempts which brought no answer he went around to the window through which the light had shown and called an explanation to the room's occupant. This achieved success, and presently Miss Gilgert came to the door in her night robe, still visibly frightened, and said, "We thought you were those awful smugglers coming back. They were here only three days ago."

The next day was one of tremendous interest, George and I began our explorations of the hills and arroyos at dawn, and soon had filled our pails and boxes with rare and fascinating cacti. Under the Palo Verde we found handsome clusters of Main's mammillaria, and on gravelly hills the colorful Rainbow Cactus. In the sandy washes were patches of the rare *Mammillaria fasciculata*, a name around which my father was never able to twist his tongue. In the yard of the little Indian dwelling by the international fence there grew a magnificent specimen of *Lophocereus schottii* from which we cut suitable branches for our collection. The Indians accepted a tip for this pruning operation and then, mindful of money, proceeded to sell us a set of their huge, home-baked ollas.

The time was going fast, yet there was much more we wanted to do and see. My desert hillscape at home could receive a good many specimens without overcrowding, and it would be particularly enhanced, I thought, by a big group of organ pipe cactus at its summit. We had already chosen a hillside on the Papago Reservation from which we were permitted to obtain these specimens, but it was a long way from San Miguel, and it was already sunset when we left the village. Shortly after the sun went down, however, the full moon rose in a brilliance that is seldom seen except where such broad expanses of white sand and smooth desert rocks reflect and spread the

light. The whole desert was illuminated and the towering saguaros cast sharp, dark shadows across the sand.

While the moon was reaching the zenith, and as we approached the mountain upon which the organ pipe cactus grows, we turned off our headlights and drove by the light of the moon, adjusting our eyes also to the lesser brilliance in order not to pass by our chosen spot. Some fifteen miles from the mining town of Ajo we pulled up to the side of the road and began to unpack our collecting apparatus. We were going to get big specimens, six or seven feet tall and as heavy as a man. With flashlights, a saw, and dozens of burlap bags we set off up the mountain slope toward the magnificent candelabra among the rocks.

The Organ Pipe cactus, *Lemaireocereus thurberi*, has achieved prominence in recent years with the establishment of the National Monument for its preservation in southern Arizona. Although exceedingly abundant in Mexico, it reaches within our borders only on a few desert mountain-slopes in the Ajo and Gowler Mountains. The tall spires are crowned in spring with night-blooming flowers, and in summer with round, red fruits, the Mexicans call it *pitahaya dulce* for its sweet flavor, and wherever it grows it serves the desert dweller with fresh, succulent fruit during the seasons of heat and drought when all leafy things have withered.

By three o'clock in the morning we had cut several big branches, wrapped them heavily in burlap and had carried them down to the road where they lay on the shoulder waiting to be loaded into the trailer. During the hours we had been working up on the hill with our flashlights blinking about among the rocks and bushes few cars had passed by, but one had slowed down in passing as if to see what odd business was being pursued at that unreasonable hour, and had then gone on into Ajo. Just as we were loading our strange cargo another car came from the direction of Ajo and passed by slowly with the lights off to observe us. On down the road it turned and came back to a stop. The Ajo sheriff stepped out, approached the row of long, man-sized bundles and demanded, "Just what is going on here?" He was obviously much disturbed at being called out of bed at two in the morning to investigate strange happenings fifteen miles out in the desert.

"Oh, we're just collecting cactus plants. Fine specimens you have down here! Want to see our permits?"

For a moment the sheriff acted as if he were about to have a short-circuit. Then his heated exclamations subsided as we calmly talked to him and terminated with the explanatory announcement: "Some danged fool told me there was a smuggling party out here with a bunch of Chinamen wrapped up and lying by the road."

E. Y. DAWSON

☆ Reading and Reference ☆

THE ROYAL HORTICULTURAL SOCIETY DICTIONARY OF GARDENING.
Edited by Fred J. Chittenden. 4 volumes; 2316 pages. 27 cm. Oxford. 1951.
£10.10s. (Pound = \$2.78 5/8, June 16)

Nicholson's *Gardener's Dictionary*, published 1884 to 1888 with a supplement in 1901, was long a standard reference of British horticulturists. The new *Dictionary*—better called an encyclopedia—is based on Nicholson's but is completely rewritten. It aims to describe all plants suitable for cultivation in the British Isles, both outdoors and under glass, and to tell how they may best be grown.

The genera are taken up alphabetically; and in the same alphabetical sequence are brief accounts of the plant families, definitions of botanical and horticultural terms, explanations of specific epithets both descriptive and commemorative, and many articles on horticultural subjects including various insect pests and plant diseases. There are no keys to families or genera. For each genus there is given the origin of the name, the family, the approximate number of species and their distribution, a brief description, and some directions for cultivation. Keys to species are given in a small proportion of the genera, though it is not clear why these particular genera were chosen. As is almost necessary with the two-column format, keys are of the non-indented type.

Under each genus, the species are alphabetical. After the Latin name (in bold-face type), there follow (as appropriate or available) the common name, a brief description, the distribution, the date of introduction, references to published illustrations, synonyms, the treatment of varieties, and miscellaneous remarks. Species of special horticultural merit are starred. Botanical authorities for the names are not given. Interspersed in the text are perhaps 1500 rather plain line drawings.

The *Dictionary*, begun in 1939, was about seven-tenths done by the end of 1942 despite increasing difficulties because of the war. The editor died in 1950. Since the first two volumes had already been printed, those who took over were unable to make changes in these volumes but could only add a few postscripts. As a result, there are some inconsistencies of treatment and of cross referencing.

In the early part of the work, much of the writing was done by the editor, but others contributed the treatments of trees and shrubs, conifers, orchids, cacti and other succulents, etc. After the death of the editor, the work was taken over largely by W. T. Stearn. The articles on cacti and other succulents mostly bear the initials of Mrs. Vera Higgins, well known as author of three books on the subject and as former editor of the *Cactus Journal*.

In the Crassulaceae, generic treatment almost exactly follows that of Berger. Thus such genera as *Bryophyllum* and *Rosularia* are maintained, whereas *Hasseanthus elongatus* and *Graptopetalum paraguayense* go into *Sedum*, *Dudleya* and *Stylophyllum* into *Echeveria*, and *Graptopetalum*

amethystinum into *Pachyphytum*. About 325 species are treated as compared to over 400 supposed to be grown in this country. *Aeonium*, *Kalanchoe*, *Sedum*, and *Sempervivum* apparently are the only genera of succulents provided with keys.

The generic division of the Cactaceae closely follows that of Britton and Rose, with the addition of few genera. In the Aizoaceae, 11 segregate genera are treated separately, but others scarcely less distinctive are retained in *Mesembryanthemum*.

The new *Dictionary* is comparable for Britain to L. H. Bailey's *Standard Cyclopaedia of Horticulture* (1914-17) and *Hortus Second* (1941) for the United States and Canada. It differs in trying to cover all plants suitable for cultivation rather than just those supposed to be in cultivation. In scope of taxonomic treatment, the *Dictionary* is intermediate between the *Cyclopaedia* and *Hortus Second*. The *Cyclopaedia* has a rather impractical key to the families, keys to the genera of each family, and keys to the species (or groups of species) in the larger genera. Hence it may be used to identify a plant when the genus or even the family is unknown. It has single citation of authorities. *Hortus Second* has no keys and no authorities.

The *Dictionary* is of course more up-to-date than the *Cyclopaedia* and (at least in the third and fourth volumes) than *Hortus Second*. Since there is a very large overlap between the plants grown in this country and those suitable to be grown in Britain, the *Dictionary* will be very useful here.

REID MORAN

An *Index* for the "Cacti of Arizona" (Lyman Benson) has been prepared by Walter S. Phillips, Head Department of Botany and Range Ecology of the University of Arizona, Tucson.

The Henry Shaw Cactus Society is holding a Fall Cactus Show at the Missouri Botanical Garden, October 4-5, 1952. An elaborate schedule has been prepared, with Frank W. Muchow, Jr. and Anna M. Frank in charge of the affair.

Maps and charts relating to succulent plants from the collection of Mrs. Herbert Spencer Rooksby were exhibited at the International Flower Show held in Los Angeles. Included were distributional maps of desert, semi-desert and Apline desert regions of the world. Another map showed distribution of Crassulaceae in the northern Hemisphere; the third the Agaves and Liliaceae. These, all in water color were the work of Donald A. Johansen. Another item was a phylogenetic chart of cacti showing the evolutionary relationships by A. V. Fric, of Prague, Czechoslovakia.

I wish my customers and friends to be informed that my new Cacti Price List 1952 is ready. Again I have many new varietie to offer. If you are interested, please write to:

FRITZ SCHWARZ
APARTADO POSTAL 347
SAN LUIS POTOSI, S.L.P.
MEXICO